Pillowcase Research 2024

Executive Summary

In this report, we confirm the effects of the YouthSecret pillowcase's ability to prevent wrinkles and hair damage. We rely on published research as well as reproducible test data to substantiate our claims.

- It is well established that sleeping on a regular pillowcase leads to sleep lines that eventually become wrinkles. The American Academy of Dermatology (AAD) and WebMD have both recognized that sleeping on a standard pillowcase is the 4th leading cause of wrinkles.
- Numerous scientific studies have shown that sleep lines and hair damage are a result of shear stresses/friction and direct forces acting on the skin from long term contact from a pillow with a standard pillowcase.
- Third-party testing has shown the YouthSecret pillowcase has less than 7-12 times the stress/friction as silk on skin. The YouthSecret pillowcase is designed with stretchable materials and a low-friction interface that will not allow the build-up of shear stress/friction preventing sleep lines from forming and hair from being damaged.
- United Home Brands has performed reproduceable laboratory and clinical tests demonstrating between 50% and a 30% decrease in crease development and sleep line formation, respectively.
- The Patented YouthSecret Pillowcase overwhelmingly beat silk including our main competitors, Slip and Blissy, in every scientific test. These tests proved our fabric blend is 10 times less absorbent than silk and cotton, 20 times more breathable than silk and 5 times more than cotton and many times more durable than silk as it is recommended to be machine, rather than hand washed.
- Quantified scientific test demonstrate over 50% less hair damage and morning frizz.
- Eco Friendly - According to the Higg Index, silk has by far the worst impact on the environment of any textile, including polyester, viscose/rayon, and lyocell with the YouthSecret material scoring well.
- Cruelty Free - The fashion industry is waking up to the problem of exploiting animals for fashion and realizing there are alternatives. Our pillowcase is also eco-friendly and cruelty-free. It is made from sustainable and cruelty-free materials.

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Introduction

To confirm the effects of the YouthSecret pillowcase's ability to prevent wrinkles we rely on published research as well as reproducible test data. The substantiation requires looking at two factors independently. The first step is proving that sleep lines can become wrinkles, and the second is demonstrating that the YouthSecret pillowcase helps prevent these sleep lines from

forming. Below we separate the substantiation data and demonstrate these two facts independently.

Sleep Lines Can Become Wrinkles

The American Academy of Dermatology (AAD) and WebMD have recognized that sleeping for years on a standard pillowcase can ultimately lead to wrinkles as noted below.

"Resting your face on the (a standard) pillow in the same way every night for years on end leads to wrinkles." - The American Academy of Dermatology (AAD) [1]

"Sleeping in certain positions night after night leads to sleep lines -- wrinkles that don't disappear once you're up". – WebMD April 2011[2]

The sleep lines referred to are initially temporary creases in the skin that when you are young disappear in minutes or hours of waking up. Sleep lines are a result of shear stresses and direct forces acting on the skin from long term contact from a pillow with a standard pillowcase. When young, your skin has the elasticity that can withstand these pressures. As we age our skin becomes less resilient and these lines become permanent wrinkles, continually increasing in number, length, and depth.

This was first researched by Dr. Samuel J. Stegman who wrote an article in The Journal of Cosmetic Surgery[3] on "sleep creases" in 1987. He focused mainly on the forehead sleep lines which may develop as three or four waves across the forehead on one or both sides from chronic contact with the pillowcase during the night. Other sleep creases or lines such as the lines along the side of the nose or side of the chin also develop in a similar manner.

Dr. Stegman found that after a few nights without the head pushed into the pillow, the sleep creases were less noticeable. He observed that this could only be accomplished by changing the sleepers' position and suggested that the patient attempt to try to train themselves to sleep in such a manner as to minimize facial contact with the pillow.

A second article evaluating sleep lines was published by Dr. Fulton.[4] Dr. Fulton's article that was published in 1999 confirms Dr. Stegman's findings but offers that filling these lines is not likely to offer long term relief when compression during sleep re-establishes the crease within hours of treatment. Sleep lines will reappear eventually since the underlying behaviour that created them in the first place continues unchanged.

The theory that sleeping on one's face leads to wrinkles was again proven by research published in the Scandinavian Journal of Plastic and Reconstructive Surgery and Hand Surgery[5]. The observations were the following: "Plastic surgery must achieve the best cosmetic results, and it helps to consider certain skin lines. Aging and scars can cause the face to become lined, and we have noticed various facial lines among patients or their relations who have come to our outpatient clinic. These lines are sometimes single and there are sometimes 2-3 parallel lines generally in the same area of the face, such as the lateral orbital, temporal, frontal, and

buccal regions. After detailed evaluation, we concluded that these oblique or horizontal wrinkles were caused by the position in which they slept. *All of them slept prone, with their faces buried in the pillow, which over many years has caused wrinkling of the skin*. We think therefore that sleeping position should be considered as an etiological factor in the formation of wrinkles."

Many other dermatological and plastic surgery articles have studied this issue and have arrived at similar conclusions that sleep lines can become wrinkles.

In a study by Gerhardt LC,[6] it was noted that these factors become increasingly important as we age with the conclusion: "Adhesion is usually assumed to be the dominant factor in skin friction, but our observations imply that deformation is also an important factor in the friction of aged skin. In the elderly, lower skin elasticity and skin turgor are associated with more pronounced skin tissue displacements and greater shear forces during frictional contact, emphasizing the importance of friction reduction in wound-prevention programs."

The YouthSecret Pillowcase Prevents Sleep Line Formation

The above information shows that the forces that create sleep lines are the shear stress on the skin and the direct pressure. The peer reviewed study from Xing, Malcolm M Q for the first time confirms quantitatively that poorly chosen fabric with inappropriate garment design renders adverse actions on human skin[7]. Since that time there have been numerous published medical articles which demonstrate the correlation between fabric and stresses and their relation to skin injury[8]. One such recent study from Smith G., with 165 patients concluded that low-friction garment products have a role to play in the prevention of skin breakdown and appear to be both clinically effective and cost effective[9].

Currently there are many low friction medical products on the market, all used to prevent skin injury. These are commonly used around joints, high pressure regions and bony protuberances. They are sold by many companies such as Parafricta (UK)[10] and Tamarack Habilitation Technologies (US)[11].

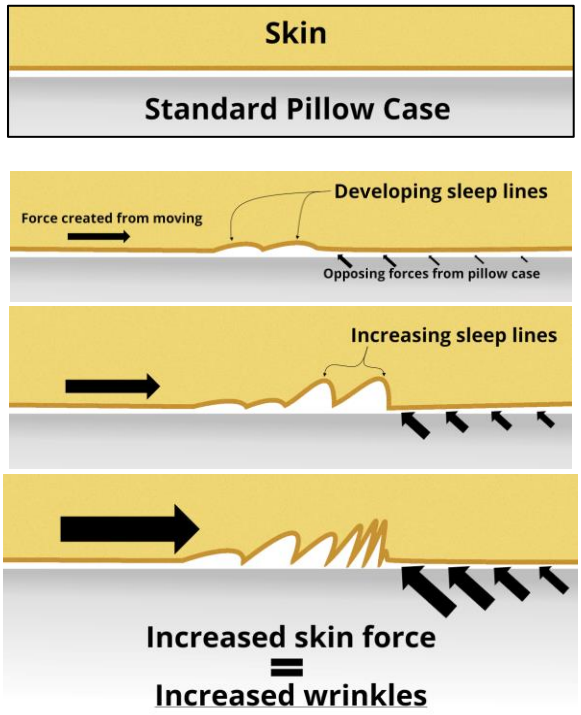
At United Home Brands our solution to creating the anti-wrinkle pillowcase began by working towards eliminating sleep lines. Initially, we reviewed both dermatology research and materials engineering data to understand the forces exerted on the skin. We then identified three external factors (shear, pressure, and material bunching) as the root cause of skin lines. Using mechanical engineering technique, the unique and patent pending YouthSecret solution was designed. The YouthSecret™ pillowcase eliminates the undesired pressures on the skin while maintaining the experience of using a normal feeling pillowcase. Below is a brief description of the data and analysis involved in our design process for the YouthSecret™ Pillowcase.

Analysis of Sleep-Line-Creating Forces on a Standard Pillowcase

According to the AAD, wrinkles are a result of both internal forces created from physiologic changes in the skin and external forces such as pressure on the skin surface and environmental

factors such as the sun. Our investigation is only directed at understanding and solving the problem of external forces acting on the skin.

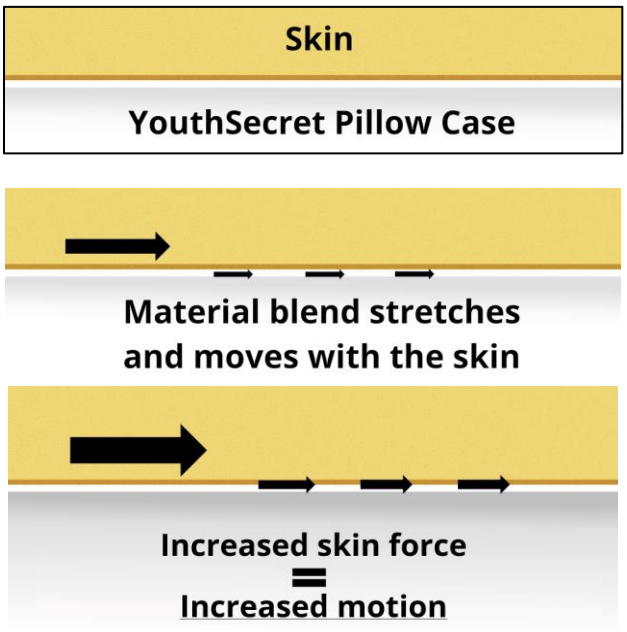
As shown in Fig 1 below, sleep lines caused by shear stress are a result of parallel differential motion of your skin relative to the standard pillowcase. As you move, your skin moves over the standard pillowcase fabric surface and as a result, friction and associated shear stress is created. The shear stress stops regions of the skin from moving. The skin then bunches up and forms creases.



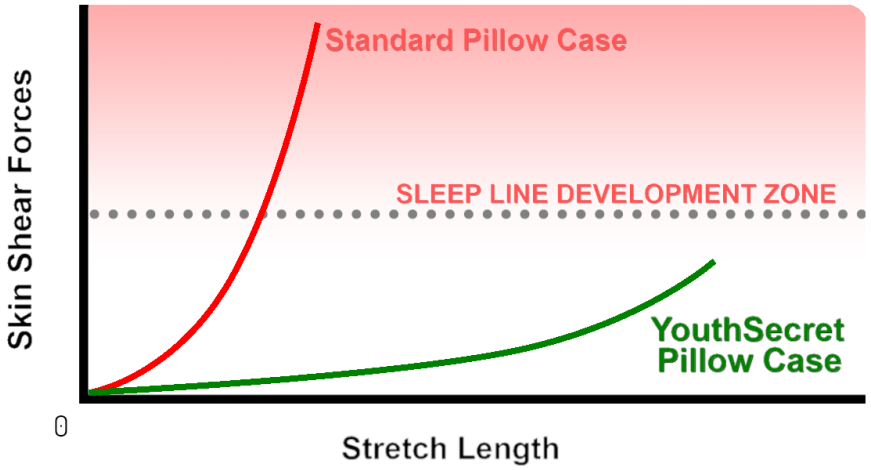
The sleep line development has a second component: the force created by the weight of the head acting in a perpendicular direction to the shear stress. This force then acts upon the sleep line by increasing the pressures, further deforming the skin.

YouthSecret Solution

Counteracting the forces of shear and direct pressure, while keeping the experience of sleeping on a normal pillow, were our design objectives. To eliminate shear, we employed a common mechanical engineering solution using both stretchable materials and low-friction interface that will not allow the build-up of "parallel" pressures. As the skin contacts the fabric blend, the pressures that would normally be created and maintained are released due to the material stretching. Therefore, as skinfolds are developing the energy is dissipated and the skin lies flat as can be seen in the figure below.

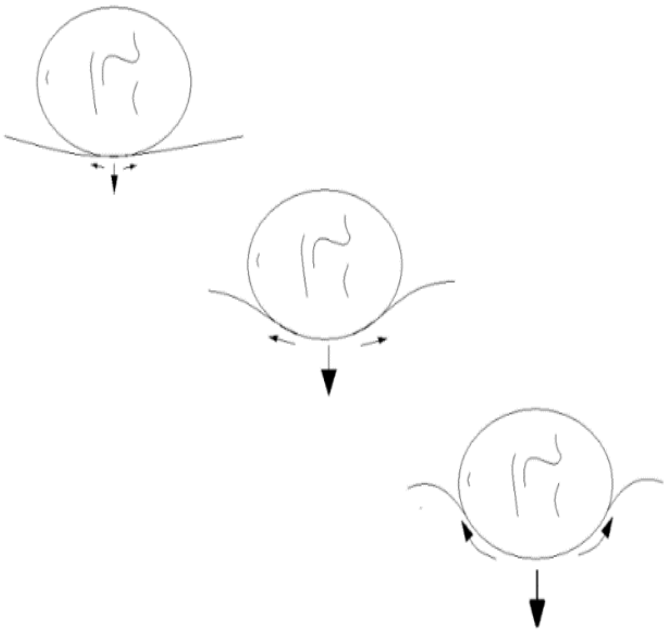


As your skin moves our fabric blend stretches and moves with it, eliminating sleep lines. In the graph below it can be seen that forces on your skin from a standard pillowcase increase rapidly, beyond the limit for the skin to crease – well above the "sleep line development zone". The YouthSecret pillowcase stretches and keeps the stress low, below the level required to create skin creasing.



Elastic Layer, Shear Stress and Direct Pressure

A second feature of the stretchable material is that as the direct pressure of the head is applied to the pillow a constant positive sheer force is created that works to keep the skin tight. The more direct (perpendicular) force there is, the greater the positive shear becomes to keep your skin tight as shown in Fig. 3 below.



Additionally, the YouthSecret blend of materials eliminates sleep lines by stretching when your head exerts pressure on the pillow.

Material Bunching Effects

The final factor creating sleep lines is that of material bunching and pressure. When you look at standard pillowcases there are fabric wrinkles that naturally occur due to excess materials. As we sleep, we move and this creates waves of material that can "bunch-up" under our skin. This bunched-up material with the exerted pressures of your head result in sleep lines. The YouthSecret pillowcase eliminates bunching as the elastic cover fits tight over a standard pillowcase.

The above etiology and associated sleep line tests considering the construction of an alternate pillowcase design were also describe in the 2012 article from Polijsak et al. below:

Independent Research

The influence of sleeping on formation of facial wrinkles. [12]
Poljsak B, Godic A, Lampe T, Dahmane R.
J Cosmet Laser Ther. 2012 Jun;14(3):133-8.

OBJECTIVE: The study addressed the influence of sleep as an important and overlooked contributory factor to the formation and progression of facial wrinkles and an alternative pillow was designed to reduce them.

MATERIALS AND METHODS: Fifteen healthy young participants of both sexes (aged 26-42 years) volunteered for this study. We used a transparent PVC pillow filled with air to demonstrate mechanical forces and deformations of the face as a consequence of sleeping on a pillow. We used a Podometer (PDMTR) (integrated fluorescent luminaire lamp) as a diagnostic device to visualize and to document the imprint of facial deformities on a glass, as seen during sleeping.

RESULTS: We observed various facial deformities and wrinkles during sleep ('crow's feet' fine lines, lines around the mouth, flattening of the forehead, blunting of the nasofrontal angle, melolabial and nasolabial folds) and designed an alternative pillow to reduce them by redistributing the pressure from the wrinkled parts of the face.

United Home Brands Studies

Trial 1: We performed similar research however needed to provide an “inverse experiment” compared with that of Poljsak B (cited above) in that observations would be needed to visualize the wrinkle formation with the YouthSecret pillowcase. To do this we created an experiment (water bag test) using a sealed bladder of fluid to act as the skin which was placed over the YouthSecret Pillowcase and a standard pillowcase as our control. The bag had a surface area of contact of 16 sq. inches and a total of 2.5 pounds was applied by hand. The pressure was measured by means of a scale beneath the pillow. Linear motion was then applied at a distance of 1inch lateral to either side of the fluid bladder at a rate of 1 cycle per second. Visual measurements were then taken of the number of wrinkles formed per cycle, measured over a period of 60 seconds. This was performed using a standard cotton pillowcase and the YouthSecret pillowcase covering a standard pillow. The below data is a result of our studies:

	Standard Pillowcase	YouthSecret Pillowcase	Difference
Average wrinkle count/cycle*	4.3	2.2	49%

**15 trials performed at 1-minute intervals using 1 cycle/second*

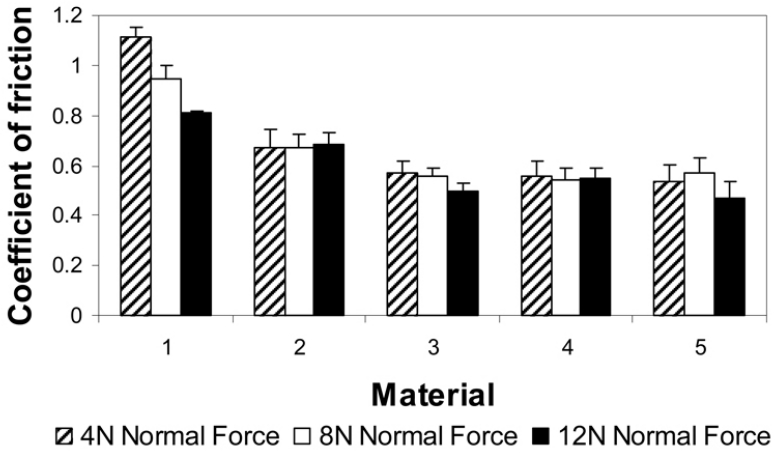
To see the YouthSecret “water bag” test follow the link:
https://www.youtube.com/watch?v=qQm-xcfsYEI (13)

Trial 2: Early data from YouthSecret sleep participant study using alternating night sleep on the YouthSecret Pillowcase and a standard pillowcase demonstrated results showing decrease sleep line formation. The study followed a single participant through 40 sleep cycles of greater than 45 minutes in the evening after the subject finished work. Although ongoing, the data confirms decrease sleep line formation which was less than the water bag results but still statistically significant at nearly 30% difference between the pillowcases. This data also surprisingly showed that sleep lines were commonly formed on the participants neck which

were also decreased to a nearly 20% difference with the YouthSecret pillowcase. Although the facial sleep lines appear to be mostly from friction, we are uncertain if these neck skin lines are a result of friction or the bunching effect as described below.

Claim of "2X Silkier than Silk"

"2x Silkier than Silk" is a trademarked marketing term used to illustrate the properties of the pillowcase. It relies on actual scientific data. The term refers to the difference between the coefficient of friction between silk and skin and our proprietary blend of fabrics. It is an accurate comparison as our design allows the "slip" registered when calculating the coefficient of friction to be between materials as our outer layer stretches and is not intended to "slip" on the skin. The data for the silk-skin coefficient was calculated by the National Institute of Health (NIH) study[14] as 0.68 as shown in the below chart:



Coefficients of friction at various normal forces and on different materials: 1=sandpaper, 2=silk, 3=polyester, 4=cotton, 5=rayon. The inter-trial (A) and inter-subject (B) variability is shown as the standard deviation bars. (A) A representative subject. The averages (10 trials) and the standard deviations. (B) The group means (n=12 subjects) and the standard deviations.

YouthSecret fabric blend coefficient of friction was calculated by using the method described by the government publication "Coefficient of Friction of Fabrics"[15] with serial test results indicating a coefficient of friction between .24 and .31 which is less than half that of silk on skin, hence "2x Silkier than Silk" meaning it is two times slipperier than silk.

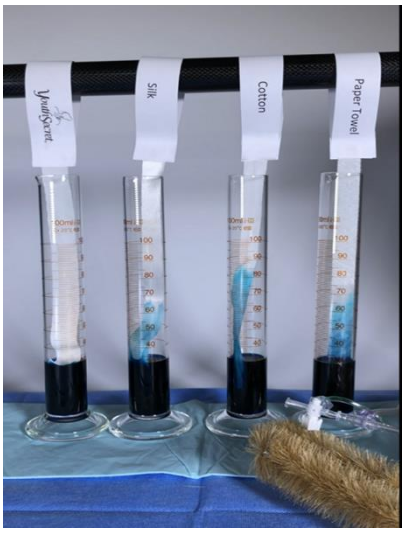
For additional verification United Home Brands employed TexTest, a third-party fabric testing company to independently verify the friction results discussed above. Samples of the YouthSecret pillowcase were tested in their labs confirming our prior data and even demonstrated lower coefficients of friction in the range of 0.04 to 0.16 for our specific blend of materials. This independent research shows that our materials are actually greater than "7x Silkier than Silk". This data is available on request.

Materials Studies

The Patented YouthSecret Pillowcase overwhelmingly beat silk, including our main competitors, Slip and Blissy, in every scientific materials test. These tests proved our fabric blend is 10 times less absorbent than silk and cotton, 20 times more breathable than silk and 5 times more than cotton and many times more durable than silk as it is recommended to be machine, rather than hand washed. Additionally, the materials are synthetic and therefore rated highest for wicking which promotes moisture transfer.

Absorbency

Absorbency tests were performed using colored water and similar size material strips. Slip Brand silk was used and cotton from a standard pillowcase. The outer spandex layer from the YouthSecret pillowcase was chosen as it is the layer which contacts the skin. The test was carried out to 10-minute and 20-minute delays. As shown the YouthSecret material demonstrated almost no absorbency whereas silk, cotton and the paper tower were highly absorbent.



Breathability

Breathability tests were performed using a water chamber and pressurized air. Each outlet contained a similar size piece of Slip silk, cotton and the YouthSecret fabric. The YouthSecret fabric used 2-layers whereas the silk and cotton were single layer. As shown above, the 2-ply YouthSecret material demonstrated higher breathability than the single ply silk or cotton.

Wicking Data

How Moisture-Wicking Fabrics Work

Moisture wicking relies on “capillary action,” which is the movement of a liquid (sweat, in this case) through tiny spaces within a fabric due to the molecular forces between the liquid and the fabric’s internal surfaces. Brands refine this process by carefully engineering the structure of the yarns within their fabrics and by applying a variety of treatments to surfaces within that structure.

Which Fabrics Are Moisture-Wicking?

Most moisture-wicking fabrics are synthetics like polyester and spandex: When moisture gets absorbed into a fabric’s yarns, it’s trapped there instead of moving through the fabric. That’s a recipe for poor moisture-wicking performance. Synthetic fabrics are “hydrophobic,” which means they resist the penetration of water. That’s why you see a lot of synthetic fabrics, like polyester or nylon, excel at moisture wicking.

Wool is also considered moisture-wicking: Wool is a slightly different animal. It actually absorbs a small amount of liquid into the core of its fibers, but it also wicks moisture out through small openings within the fabric. The result is that the surface of wool yarns remains dry to the touch.

Cotton is the “anti-moisture-wicking” fabric: The classic example of a non-wicking fabric is cotton, which gets completely saturated with sweat and then takes forever to dry. Initially, it makes you feel hot and sticky; ultimately, it leaves you feeling cold and clammy. You can find cotton fabrics that have been specially treated to make them moisture wicking, but their performance lags behind synthetics and wool.

Hair Damage and Morning Frizz Studies

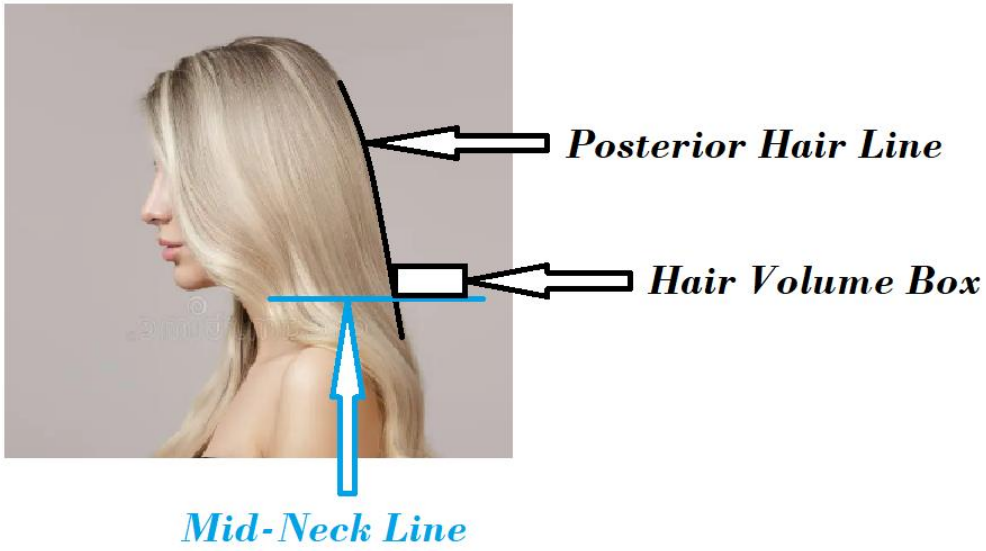
Although there are numerous NIH studies regarding hair loss because of friction and pressure (pressure alopecia and tension alopecia) we could not find any studies on hair loss and frizz from pillowcases. This is not to say that there is not data available as many pillowcase brands and large cosmetic companies make the connection. As such, we decided to perform several control studies that compare the YouthSecret Pillowcase to cotton pillowcases regarding hair damage and frizz.

Test 1: Hair Damage control test:

We chose a cohort of women that had all types of hair (curly, frizz and straight) with length below the shoulders and had them sleep for 2 weeks with a cotton pillowcase and the following 2 weeks with the YouthSecret pillowcase. Prior to going to bed, each subject brushed their hair in their normal dally fashion. They then checked the pillowcase for any hairs with a focused light. Any hairs found would be discarded. The women slept normally. When awake and getting out of bed, they checked their pillowcase and counted any pieces of hair. This data was then tabulated in chart form. The results indicated that the YouthSecret pillowcase had much less "hair damage" with an average hair count of (8 hairs/14 days) = .57 hairs/night. **Cotton hair damage was much greater** observing and avg. of (17 hairs/ 14 days) = 1.2 hairs/night, or **nearly twice the hair damage/loss.**

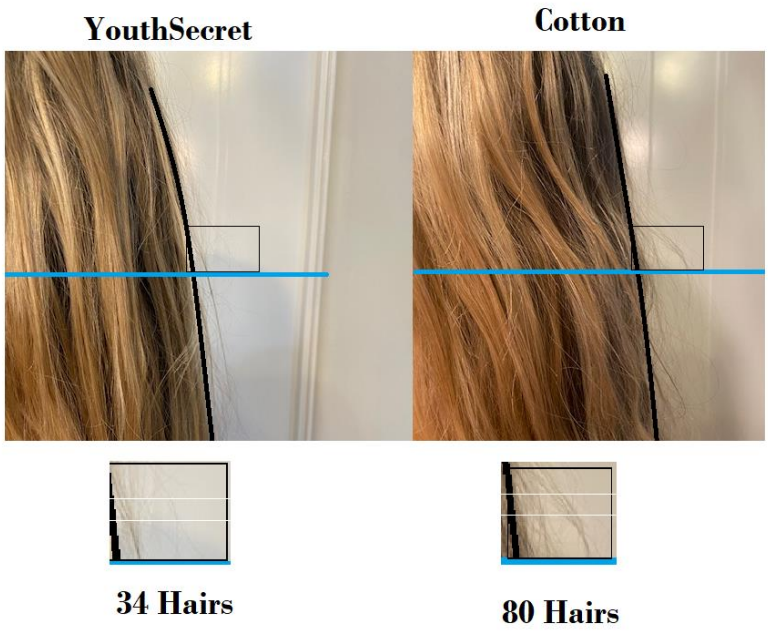
Test 2: Frizz Index

The Frizz Index is a simple, controlled test that measures the amount of frizz, or misaligned hair with respect to the general flow direction of the bulk of hair. Below is a diagram showing the means to calculate frizz:



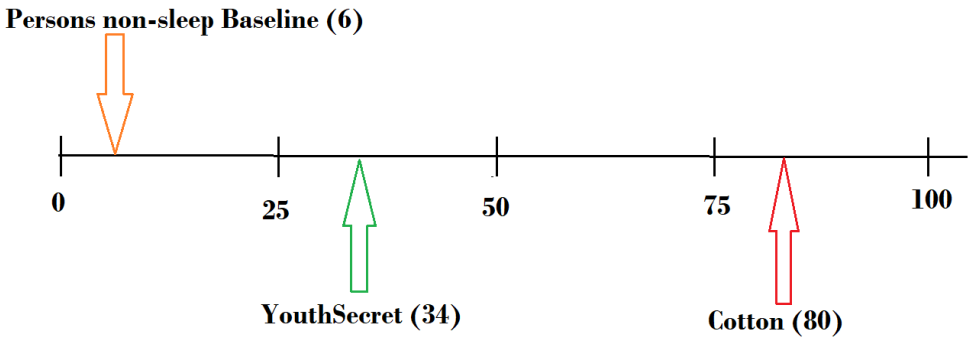
A profile view of a subject is taken from the shoulders to the top of the head. The "Posterior Hair Line" is then drawn along the normal hair line where the bulk of the hair transitions. This can be used for any type of hair as it is the final hair count that matters not the relative hair

count per test. The mid-neck line is drawn (in blue) at the mid aspect of the neck. Above this line, the hair volume box is drawn, which extends from the posterior hair line to a region where no further hair is detected. As shown below, the hairs in the hair volume box are then counted:



Estimated Hair Count in Hair Volume Box

This data is then plotted on the Frizz Index. Our actual test data from our studies is shown below:



Frizz Index Scale

This data represents the average data from our 14-day cotton vs YouthSecret test showing significantly less frizz from the YouthSecret Pillow case. Although not formally tested, we have had feedback from users noting that with the YouthSecret Pillowcase they can go much longer without washing their hair and that it is much easier to fix their hair in the morning.

Eco Friendly

According to the Higg Index, silk has by far the worst impact on the environment of any textile, including polyester, viscose/rayon, and lyocell. It's worse than the much-demonized cotton, using more fresh water, causing more water pollution, and emitting more greenhouse gases. Mar 4, 2020.

The Higg Index: Developed by the Sustainable Apparel Coalition, the Higg Index is a suite of tools that enables brands, retailers, and facilities of all sizes — at every stage in their sustainability journey — to accurately measure and score a company or product's sustainability performance. The Higg Index delivers a holistic overview that empowers businesses to make meaningful improvements that protect the well-being of factory workers, local communities, and the environment.

Cruelty Free

The fashion industry is waking up to the horrors of exploiting animals for fashion and realizing there are alternatives. Chanel will no longer use fur or exotic animal skins, and Coach and dozens of fashion houses banned fur. It is more than possible to make clothing and cosmetics without harming animals, as Rihanna's business ventures prove. In 2017, Rihanna released her Fenty Beauty line which is completely cruelty-free. She's continuing this cruelty-free trend with her new silk-free, completely vegan Valentine's Day lingerie collection! The reasons - Some 6,600 silkworms are killed to make just 1 kilogram of silk. As per PETA "don't be fooled by "peace silk". "The only truly cruelty-free options are those that aren't derived from animals. Fortunately, there are many luxurious animal-friendly fabrics available, such as nylon, polyester, Tencel, milkweed seed-pod fibers, silk-cotton tree filaments and rayon."

Conclusion

Through prior independent research it has been shown that sleep lines can become wrinkles and that sleeping on a standard pillowcase can lead to sleep lines. Numerous studies have shown that proper selection of materials can prevent injury to the skin and many of these materials are used in healthcare today. Many of these products utilize anti-friction/shear combinations of fabrics to eliminate undesirable forces on the skin. We have shown that our patent-pending blend of materials is successful in eliminating the development of sleep lines in our model and participant trials and as such will decrease wrinkle formation. Additionally, our analysis on hair and related damage and fizz proved the YouthSecret pillowcase is essential for hair health. The shown hair care improvements are non-specific and will benefit everyone regardless of age, gender, race and hair type.

References

1. American Academy of Dermatology. (2010). Annual Statement. Retrieved from http://www.skincarephysicians.com/agingskinnet/basicfacts.html

2. WebMD. (2010). Top 23 Ways to Prevent Wrinkles. Retrieved from http://www.webmd.com/healthy-beauty/features/23-ways-to-reduce-wrinkles and http://www.webmd.com/healthy-beauty/features/aging-skin-do-you-look-older-than-you-should

3. Stegman, S.J. (1987). Sleep creases. American Journal of Cosmetic Surgery, 4, 277-280.

4. Fulton, J.E. Jr., & Gaminchi, F. (1999). Sleep lines. Dermatologic Surgery, 25(1), 59-62.

5. Sarifakioğlu, N., Terzioğlu, A., Ates, L., & Aslan, G. (2004). Scandinavian Journal of Plastic and Reconstructive Surgery and Hand Surgery, 38(4), 244-247.

6. Gerhardt, L.C., Lenz, A., Spencer, N.D., Münzer, T., & Derler, S. (2009). Skin-textile friction and skin elasticity in young and aged persons. Skin Research and Technology, 15(3), 288-298.

7. Xing, M.M.Q., Sun, Z., Pan, N., Zhong, W., & Maibach, H.I. (2006). An EFE model on skin-sleeve interactions during rotation. Journal of Biomechanical Engineering, 128, December.

8. Carlson, J.M. (2006). Functional Limitations From Pain Caused by Repetitive Loading on the Skin: A Review and Discussion for Practitioners, With New Data for Limiting Friction Loads. Journal of Prosthetics & Orthotics, 18(4), 93-103.

9. Smith, G., & Ingram, A. (2010). Clinical and cost-effectiveness evaluation of low friction and shear garments. Journal of Wound Care, 19(12), 535-542.

10. Parafricta. Retrieved from http://www.parafricta.com/

11. Tamarack Habilitation Technologies. Retrieved from http://www.tamarackhti.com/#Home

12. Poljsak, B., Godic, A., Lampe, T., & Dahmane, R. (2012). The influence of sleeping on the formation of facial wrinkles. Journal of Cosmetic and Laser Therapy, 14(3), 133-138.

13. YouthSecret. (2012). Pillowcase Water Test. Retrieved from https://www.youtube.com/watch?v=gQm-xcfsYEI

14. Savescu, A.V., Latash, M.L., & Zatsiorsky, V.M. (2008). A technique to determine friction at the fingertips. Journal of Applied Biomechanics, 24(1), 43-50. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/18309182

15. National Institute of Standards and Technology. (n.d.). Coefficient of friction of fabrics – Measurement of the coefficient of friction between two pieces of material. Retrieved from http://nvlpubs.nist.gov/nistpubs/jres/5/jresv5n2p243_A2b.pdf